

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property
Organization
International Bureau



(43) International Publication Date
25 March 2004 (25.03.2004)

PCT

(10) International Publication Number
WO 2004/024469 A1

(51) International Patent Classification⁷: **B60B 3/14**,
3/16, 3/10, 3/04, B21D 53/26

(21) International Application Number:
PCT/BR2003/000127

(22) International Filing Date:
5 September 2003 (05.09.2003)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
PI0203723-8 12 September 2002 (12.09.2002) BR

(71) Applicant (for all designated States except US): **MERITOR DO BRASIL LTDA.** [BR/BR]; Av. Major José Levy Sobrinho, 2700, Limeira, CEP-13486-925 São Paulo, SP (BR).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **FRANCIS-CHETTI, Evandro, Luis** [BR/BR]; Rua Agenor Ferreira de Camargo, 100, Jardim São Roque - Limeira,

CEP-13480-338 São Paulo, SP (BR). **MARCÃO, Marcelino** [BR/BR]; Rua Euclides Xavier de Lima, 350, Limeira, CEP-13484-317 São Paulo, SP (BR). **RODRIGUES, Flávio** [BR/BR]; Rua Brasil, 238, Limeira, CEP-13486-104 São Paulo, SP (BR).

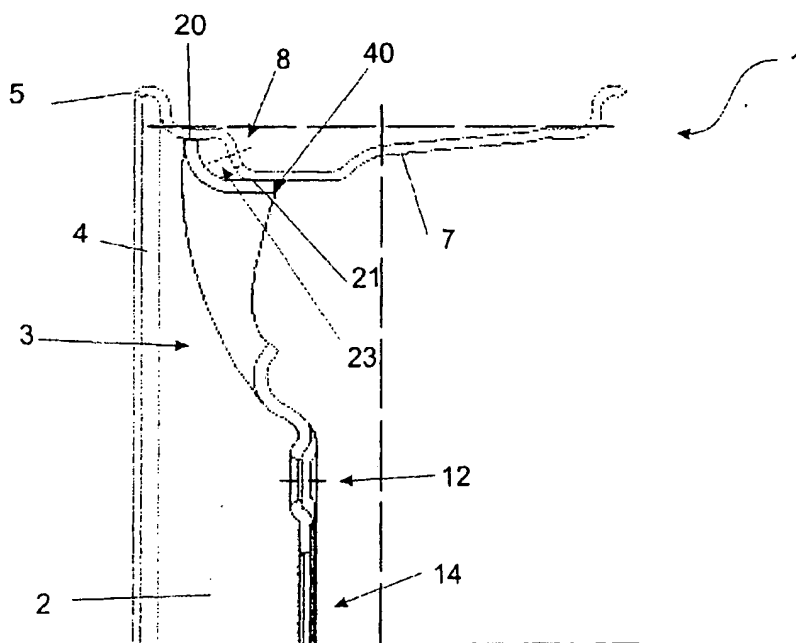
(74) Agent: **DANNEMANN, SIEMSEN, BIGLER & IPANEMA MOREIRA**; Caixa Postal 2142, Rua Marquês de Olinda, 70, CEP-22251-040 Rio de Janeiro, RJ (BR).

(81) Designated States (*national*): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) Designated States (*regional*): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE,

[Continued on next page]

(54) Title: A WHEEL AND A WHEEL DISC



(57) Abstract: It is described a wheel, particularly for use on automotive vehicles, formed by associating a substantially cylindrical wheel rim (2) and a substantially circular wheel disc (3) to each other, the wheel disc (3) comprising at least one through bore (16), the through bore (16) comprising at least one projection (37), the projection (37) cooperating with the wheel rim (2). It is also described a wheel disc (3) for use with the wheel (1) presented herein.



ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO,
SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM,
GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

— before the expiration of the time limit for amending the
claims and to be republished in the event of receipt of
amendments

Published:

— with international search report

*For two-letter codes and other abbreviations, refer to the "Guid-
ance Notes on Codes and Abbreviations" appearing at the begin-
ning of each regular issue of the PCT Gazette.*

"A WHEEL AND A WHEEL DISC"

The present invention relates to a wheel, particularly for use on vehicles, which is made from a stamped material and has a esthetics similar to that of wheels made from light-metal alloys by casting, as well as a disc for use on the aimed wheel.

Description of the Prior Art

Wheels designed for use on vehicles, particularly automotive vehicles, may be classified into two main categories, according to their manufacture process: wheel made from a stamped material and wheels made from light-metal alloys by casting.

Although the wheels made from a stamped material are easy to manufacture and have a low cost per unit, they have the drawback of not presenting an attractive design, so that their use is limited to low-cost vehicles or commercial utility/commercial vehicles, for which the esthetic factor is not of great importance. The wheels made from light metal are more flexible with regard to working-out and variation in design, thus being esthetically more attractive. However, they are expensive, their price being usually prohibitive for some segments of the automotive market.

The wheels made from a stamped material (usually carbon steel) from the prior art comprise a substantially cylindrical or truncated-cone-shaped rim and a substantially circular wheel disc, rigidly associated to each other, usually by welding, although one often uses screws, rivets, etc. as well. The stamped wheels may be subdivided into two types, according to their constructive form, which are the following.

A first type of stamped wheel is formed by a rim having two opposed end regions, or flanges, which define the region where the diameter of the wheel is maximum. The flanges are protuberant, have a substantially curved "J"-shaped or "J"-shaped profile, and define a groove for fixing a tire. These wheels are called conventional stamped wheels.

A second type of stamped wheel comprises a rim having only one wheel flange, the other flange being an integral part of the wheel disc. Again, the disc flange and rim flange define the region where the wheel di-

ameter is maximum; thus, the disc define the maximum wheel diameter on its flange. These wheels are known as integrated wheels and have the advantage of enabling one to achieve more attractive and elaborate designs, while keeping the manufacture cost low.

5 However, there are some problems associated with the integrated wheels, such as: a greater difficulty in achieving symmetry and alignment of the wheel; a design still inferior to that of the wheels made from light-metal alloys; the need for greater accuracy in the manufacture; a little higher price per unit, etc.

10 Objectives of the Invention

 An objective of the present invention is to provide a stamped wheel, particularly for use on automotive vehicles, which is esthetically as attractive to the consumer as the wheels made from light-metal alloys, more flexible with regard to the options of design than the integrated wheels, and
15 has the same low manufacture cost of the stamped wheels. The process of welding the wheel disc to the rim may be carried out with existing manufacture equipment, thus demanding little or no investment in purchasing a new equipment for the production line.

 Another objective of the present invention is to provide a wheel
20 disc for use on the above-described wheel.

Brief Description of the Invention

 The objectives of the present invention are achieved by a wheel, particularly for use on automotive vehicles, formed by associating a substantially cylindrical wheel rim and a substantially circular wheel disc with each
25 other, the wheel disc comprising at least one through bore, the through bore comprising at least one projection, the projection cooperating with the wheel rim.

 Also, the objectives of the present invention are achieved by a wheel disc, particularly for association with a wheel rim, comprising at least
30 one through bore that has at least one projection defining a second contact surface for cooperation with the rim.

 The main advantages of the present invention, among other

equally relevant advantages, are the possibility of making feasible a stamped wheel having the positive points of the conventional and integrated stamped wheels (such as the ease of obtaining symmetric and aligned wheels, low manufacture cost per unit, more attractive and more elaborate esthetics) and
5 presenting a wider variety of design options than the integrated wheels, in addition to having an appearance equivalent to that of a wheel cast from light-metal alloys.

Brief Description of the Drawings

The present invention will now be described in greater detail with
10 reference to an embodiment represented in the drawings. The figures show:

- Figure 1: a perspective view of a first constructive variation of the wheel object of the present invention;
- Figure 2: a perspective back view of the wheel illustrated in figure 1;
- 15 - Figure 3: a perspective view of a second constructive variation of the wheel of the present invention;
- Figure 4: is a perspective back view of the wheel illustrated in figure 3;
- Figure 5: a schematic cross-section view of the wheels illustrated in figures 1 – 4;
- 20 - Figure 6: a perspective view of a wheel disc of the wheel object of the present invention;
- Figure 7: a perspective view of a third constructive variation of the wheel object of the present invention; and
- 25 - Figure 8: a schematic cross-section view of the wheel illustrated in figure 7.

Detailed Description of the Figures

According to a preferred embodiment and as can be seen from figure 1, the wheel 1 of the present invention has a wheel rim 2 associated to
30 a wheel disc 3.

The substantially cylindrical rim 2 is preferably made from carbon steel and has at least two end regions 4, named flanges, which consti-

tute the regions where the wheel diameter is maximum. The flanges 4 have a free end 5 projecting from the rim 2, substantially perpendicular thereto, defining a substantially "J"-shaped or "J"-shaped profile. The flanges 4 define a substantially U-shaped intermediate region 7, configuring a channel for fixing a tire (not shown).

Preferably, a bore 8 is provided for placing a valve to control the inflation of the tire between one of the end regions 4 of the wheel 2 and the intermediate region 7, although this bore may also be positioned at any other point in the rim 2 wall.

10 The wheel disc 3 is substantially circular shape, is preferably stamped from carbon steel and comprises a first central region 31, a second intermediate region 32 and a third external region 33, as can be seen in figure 5.

The first central region 31 is substantially circular, preferably has a central bore 14, in which the tip of the vehicle axle is accommodated, and at least two adjacent bores 12 to fix the wheel 1 to the wheel hub of the vehicle (not shown), which is preferably effected by screwing.

The second substantially annular intermediate region 32 projects from the first central region 31, being concentric with the latter. The second intermediate region 32 has at least one through bore in the form of a brake-ventilation window 16. Usually, the ventilation windows 16 have the double objective of ventilating the brakes and improving the esthetics of the wheel. In the present invention, the ventilation window 16 has a new additional function that will be explained later.

25 The third external region 33 projects from the second intermediate region, is annular in shape and concentric with said first and second regions 31, 32 of the disc 3. This region defines the end of the disc 3, at which there is a first contact surface 20. The wheel disc 3 is worked out in such a way that this first contact surface 20 cooperates with the rim 2, almost touching it or slightly touching it, and gives the impression that the wheel 1 is a single piece, like the integrated wheels and the wheels made from light-metal alloys.

Preferably but not compulsorily, a tear 9 is provided in the external region 33, which overlaps the bore 8 of the wheel rim, allowing a tire-inflation valve (not shown) to pass.

In the preferred embodiment, the ventilation windows 16 are substantially trapezoidal in shape, comprising two walls 34 arranged radially with respect to the center of the disc 3, a first wall 35 that is substantially perpendicular to the radius of the wheel disc 3 and semicircular, located substantially close to the first central region 31, and a second wall 36 that is also substantially perpendicular to the radius of the disc and semicircular and is located substantially close to the third external region 33.

The second concentric wall 36 has a projection 37 facing the internal surface of the disc, that is to say, the one facing the wheel hub of the vehicle, this projection defining a second contact surface 21 between the wheel disc 3 and the rim 2. This second contact surface 21 is only present in the windows 16. Preferably, the projections 37 are substantially in form of an annular segment, but they may be in any other shapes, as long as they are functional.

Evidently, the window 16 may have other shapes than the trapezoidal one, for example, circular, triangular, hexagonal, etc. However, at least the wall (or a part of it) that is located in the external region of the wheel disc has to present a recess facing the wheel hub defining a contact surface with the wheel rim, exactly as described in the preceding paragraph.

As shown in figures 5 and 8, when the rim 2 and the wheel disc 3 are associated, the first contact surface 20 virtually or slightly touches the rim 2 at a point substantially close to the flange 4 or, alternatively, at the free end of the flange, and the second contact surface 21 cooperates with the rim 2, touching it at a point substantially located in the intermediate region 7 thereof. A small cavity 23 is formed between these two contact regions, the walls of which are defined by the rim 2 and by the disc 3.

In the first and second constructive embodiments of the wheel 1, the fixation of the disc 3 to the rim 2, which is effected by welding, occurs only on the second contact surfaces 21, as can be seen in figures 2, 4 and 5.

Since the fixing welding 40 is carried out in the back portion of the wheel disc (facing the wheel hub), and also due to the configuration of the front surface of the wheel disc, which virtually touches the flange 4, the wheel 1 has a more elaborate finishing than the stamped wheels from the prior art, giving
5 the impression that the wheel is a single piece, that is to say, the impression that the rim and the disc are continuous.

Due to the projections 37 of the second walls 36 of the windows 16, which touch the rim in homogeneous way, and also due to the first contact surface 20, defined by the third external region 33, a natural centering
10 occurs between the disc and the wheel rim, so that there is no great difficulty in manufacturing a perfectly centered wheel 1. This characteristic imparts to the invention a great advantage over the integrated-type stamped wheels, the perfect centering of which is somewhat difficult to achieve.

In addition, generally, the larger the extent of the second concentric wall 36 of the ventilation window 16 (and consequently the projection 37), the lesser the number of windows in the disc 3. In this way, the contact surface 21 will be larger and, as a result, the area available for fixing the rim 2 to the disc 3, thus imparting more strength to the wheel 1, as can be seen from a comparison of figures 2 and 4.

20 Figures 7 and 8 show a third constructive embodiment of the wheel of the present invention, in which the first contact surface 20 touches the end of the flange 4 of the rim 2. In this embodiment, in addition to the fixing welding 40 on the second contact surface 21 described above, the first contact embodiment 20 is also fixed to the flange 4 by means of a filling
25 welding 41. This effect is achieved thanks to the constructive geometry of the disc 3, conceived for said surface 20 to touch the end of the flange 4. Evidently, one may conceive any variations of the disc 3, as long as they will enable its surface 20 or an adjacent region to touch the flange.

At least two additional steps in the manufacture of this wheel
30 should be foreseen: a step for welding the first contact surface 20 to the flange 4 of the wheel 1, and a step for finishing the same welding, for instance, by machining.

Unlike the fixing welding 40, the filling welding, which is part of the finishing steps, has the function of improving the appearance and finish of the wheel and enhancing the impression that the wheel 1 is made from light-metal alloys, although this ends up by increasing the strength of the wheel 1, even if in a reduced way.

Moreover, the filling welding can prevent infiltration of moisture into the cavity 10, thus prolonging the useful life of the wheel and preventing possible corrosion problems:

Evidently, one may foresee other filling means than the welding 41, for example, glue, expanded foam, or any other material that has adhesive properties.

One may further foresee the filling welding, or the other means, on any wheel built in accordance with the teachings of the present invention, and not only in the third constructive embodiment described above.

A preferred embodiment having being described, it should be understood that the scope of the present invention embraces other possible variations, being limited only by the contents of the accompanying claims, which include the possible equivalents.

CLAIMS

1. A wheel, particularly for use on automotive vehicles, formed by associating a substantially cylindrical wheel rim (2) and a substantially circular wheel disc (3) to each other, the wheel disc (3) comprising at least one through bore (16), the wheel (1) being characterized in that the through bore (16) comprises at least one projection (37), the projection (37) cooperating with the wheel rim (2).

2. A wheel according to claim 1, characterized in that the disc (3) comprises a substantially annular end region that defines a first contact surface (20).

3. A wheel according to claim 2, characterized in that the first contact surface (20) cooperates with the wheel rim (2).

4. A wheel according to claim 3, characterized in that the first contact surface (20) cooperates with the rim (2) at a point substantially close to the flange (4).

5. A wheel according to claim 3, characterized in that the first contact surface (20) cooperates with the rim (2) at the end of the flange (4).

6. A wheel according to claim 4 or 5, characterized in that the first surface (20) is fixed to the rim (2) by welding.

7. A wheel according to claim 1, characterized in that the projection (37) faces the internal surface of the disc (3) and defines a second contact surface (21).

8. A wheel according to claim 1 or 7, characterized in that the projection (37) is substantially annular-segment shaped.

9. A wheel disc, particularly for association to a wheel rim (2), comprising at least one through bore (16) and being characterized in that the through bore (16) comprises at least one projection (37) defining a second contact surface (21) for cooperation with the rim (2).

10. A disc according to claim 9, characterized in that it comprises a substantially annular end region, which defines a first contact surface (20).

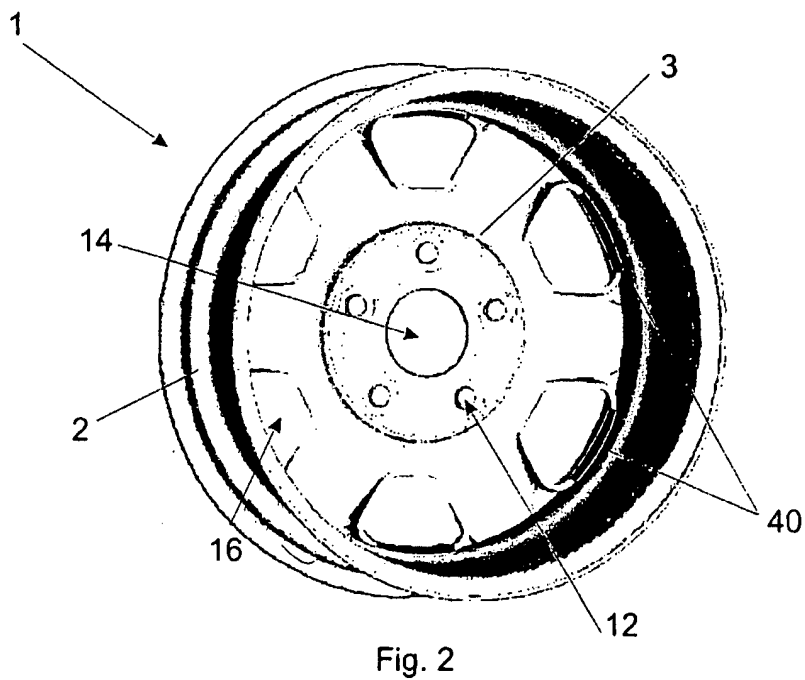
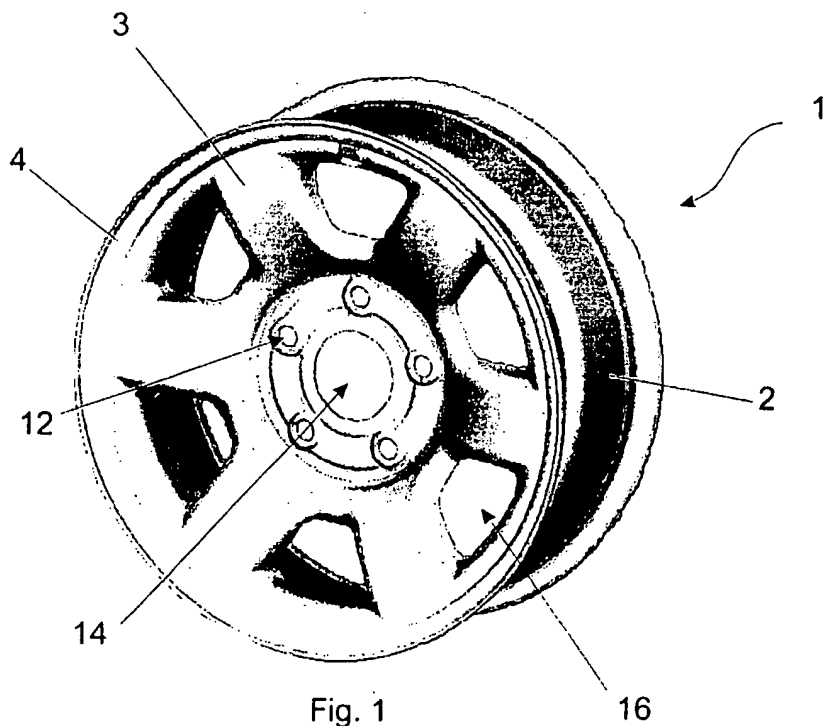
11. A disc according to claim 10, characterized in that the first

contact surface (20) cooperates with the wheel rim (2).

12. A disc according to claim 9, characterized in that the projection (37) faces its internal surface.

13. A disc according to claim 9 or 12, characterized in that the
5 projection (37) is substantially annular-segment shaped.

1/4



BEST AVAILABLE COPY

2/4

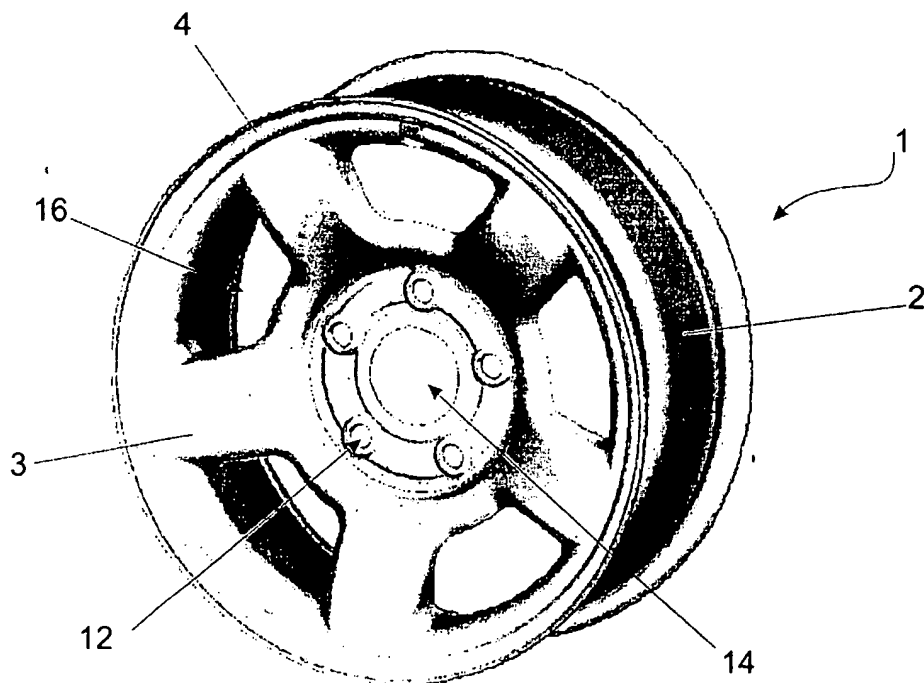


Fig. 3

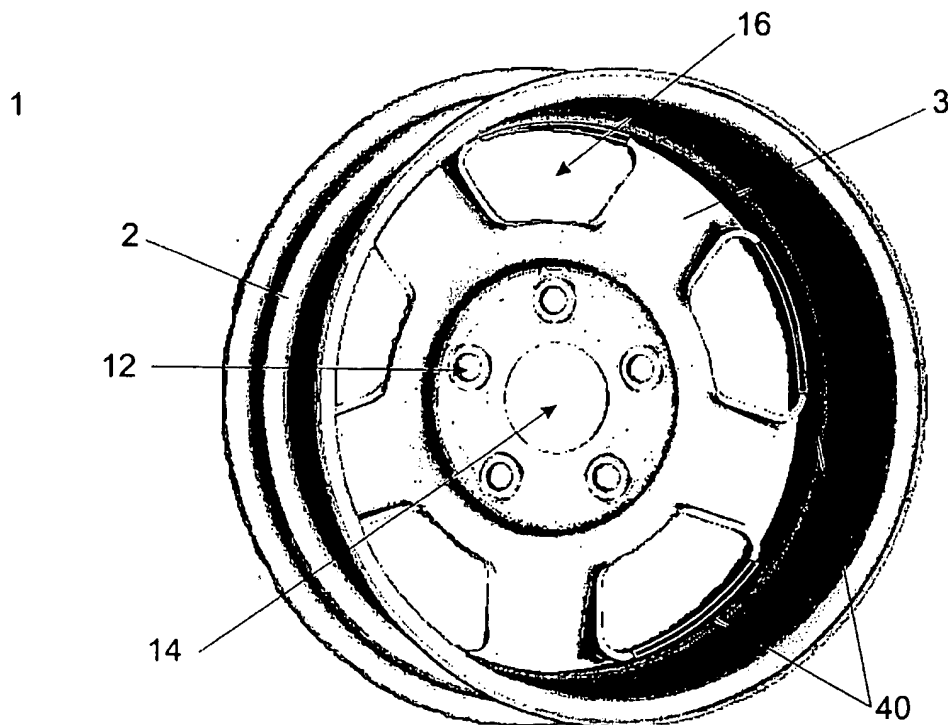


Fig. 4

BEST AVAILABLE COPY

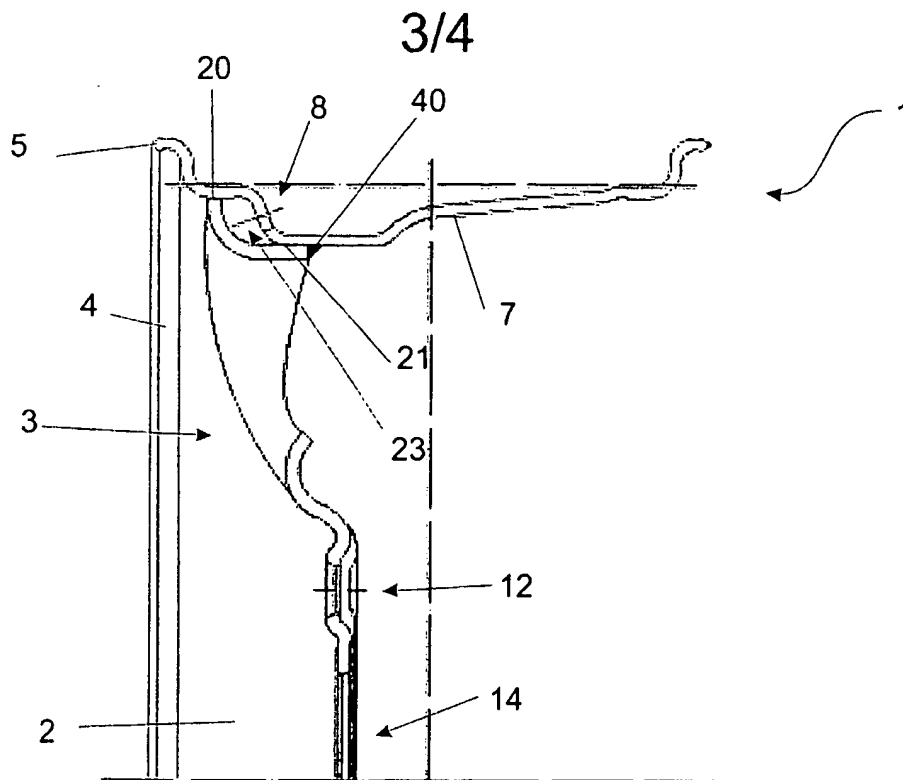


Fig. 5

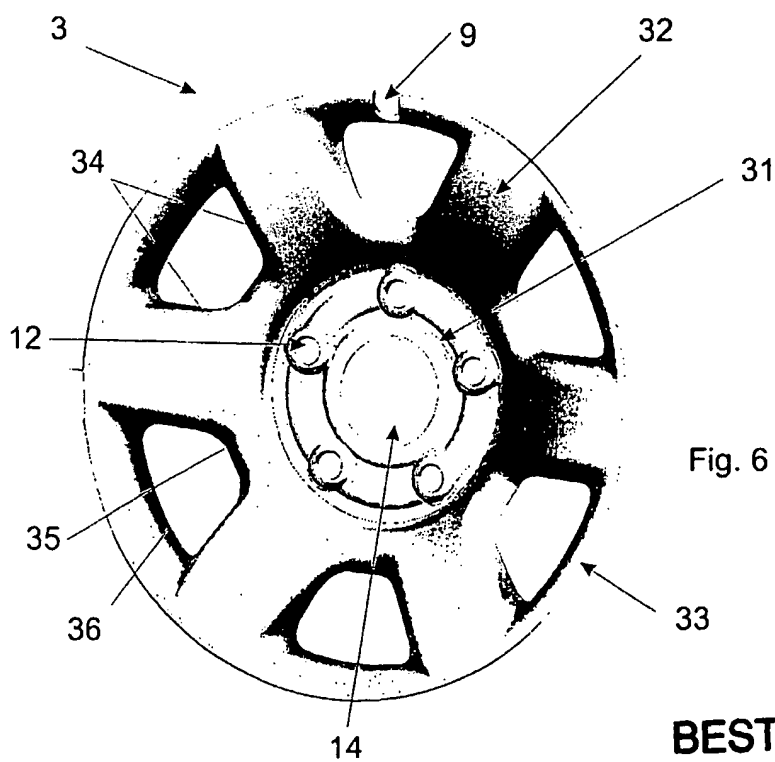


Fig. 6

BEST AVAILABLE COPY

4/4

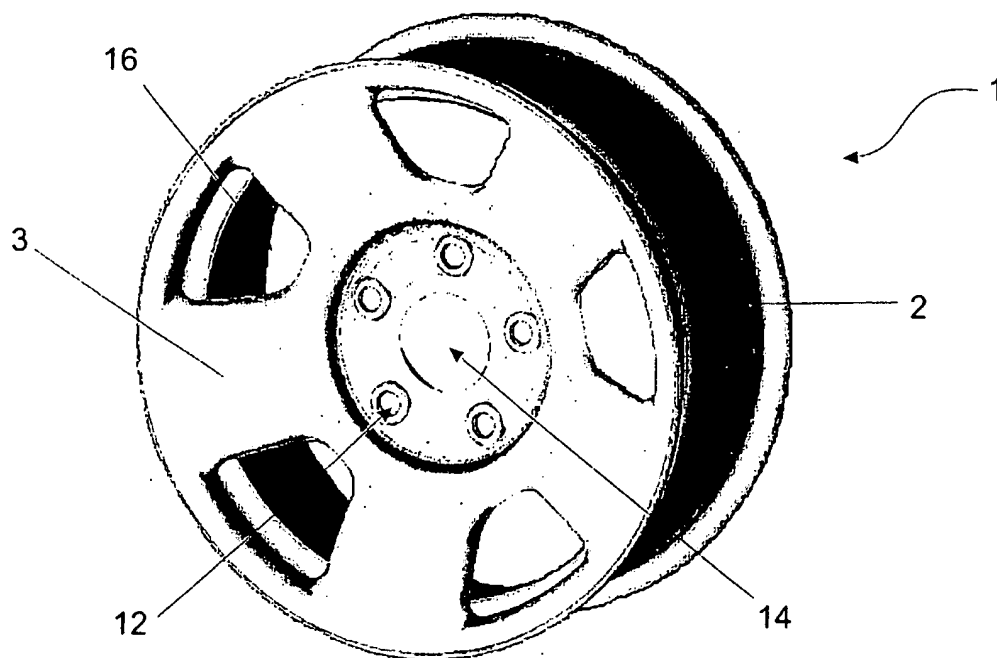


Fig. 7

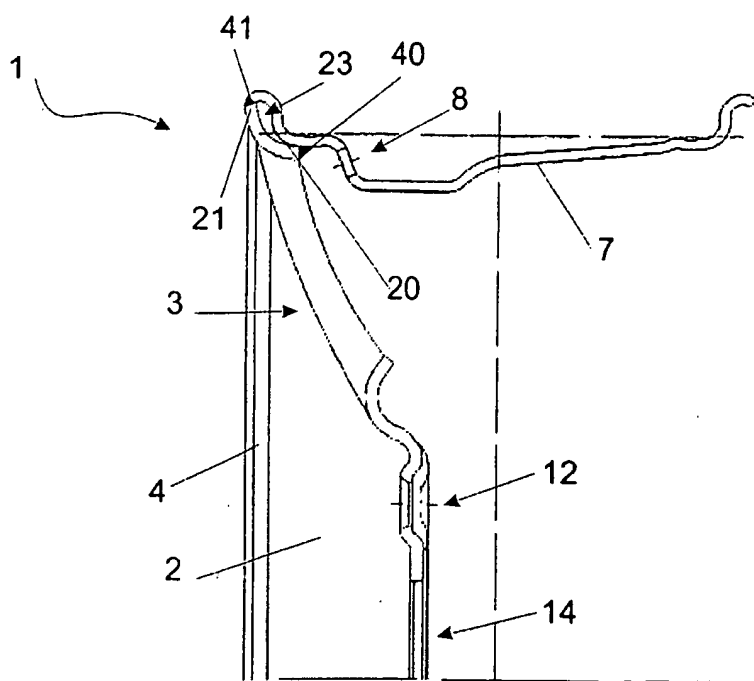


Fig. 8

BEST AVAILABLE COPY

INTERNATIONAL SEARCH REPORT

Internat. Appl. No.

PCT/BR 03/00127

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 B60B3/14 B60B3/16 B60B3/10 B60B3/04 B21D53/26

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 B60B B21D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 768 191 A (PORSCHE AG) 16 April 1997 (1997-04-16) column 3, line 44 - line 50; figures 2,6,8 ---	1-4,6-13
X	US 6 152 351 A (MAZAC KAREL ET AL) 28 November 2000 (2000-11-28) abstract; figure 1 ---	1-4,6-13
X	US 6 234 581 B1 (STACH JENS) 22 May 2001 (2001-05-22) column 2, line 37 -column 3, line 6; figure 2 ---	1-4,6-13
A	US 6 240 638 B1 (ARCHIBALD KENNETH R ET AL) 5 June 2001 (2001-06-05) abstract; figure 2 -----	1-13

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents:

A document defining the general state of the art which is not considered to be of particular relevance

E earlier document but published on or after the international filing date

L document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

O document referring to an oral disclosure, use, exhibition or other means

P document published prior to the international filing date but later than the priority date claimed

T later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

X document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

Y document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

G document member of the same patent family

Date of the actual completion of the international search

21 January 2004

Date of mailing of the international search report

27/01/2004

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Bolte, U

INTERNATIONAL SEARCH REPORT

information on patent family members

International Application No.

PCT/BR 03/00127

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
EP 0768191	A	16-04-1997	DE 19601778 A1	17-04-1997
			AU 725086 B2	05-10-2000
			AU 6582796 A	17-04-1997
			CN 1163833 A , B	05-11-1997
			DE 29623451 U1	02-07-1998
			DE 59603215 D1	04-11-1999
			EP 0768191 A2	16-04-1997
			ES 2136351 T3	16-11-1999
			JP 3091698 B2	25-09-2000
			JP 9164801 A	24-06-1997
			NO 964303 A	14-04-1997
			US 6231129 B1	15-05-2001
			US 6024415 A	15-02-2000
			DE 19625271 A1	08-01-1998
			DE 19645639 A1	07-05-1998
<hr/>				
US 6152351	A	28-11-2000	DE 19732076 A1	28-01-1999
			EP 0893278 A2	27-01-1999
<hr/>				
US 6234581	B1	22-05-2001	DE 19625271 A1	08-01-1998
			AU 711230 B2	07-10-1999
			AU 2698397 A	14-01-1998
			CN 1223613 A , B	21-07-1999
			DE 19601778 A1	17-04-1997
			DE 59702244 D1	28-09-2000
			WO 9749565 A1	31-12-1997
			EP 0907519 A1	14-04-1999
			ES 2148972 T3	16-10-2000
			JP 2000512589 T	26-09-2000
			KR 2000022221 A	25-04-2000
			NO 986085 A	23-02-1999
<hr/>				
US 6240638	B1	05-06-2001	US 5360261 A	01-11-1994
			US 6170918 B1	09-01-2001
			US 5548896 A	27-08-1996
			AU 634813 B2	04-03-1993
			AU 6230290 A	21-03-1991
			DE 4014368 A1	28-03-1991
			ES 2029603 A6	16-08-1992
			IT 1278625 B1	27-11-1997
			JP 3169701 A	23-07-1991
			JP 3185144 B2	09-07-2001
			KR 163427 B1	01-12-1998